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ABSTRACT

The primary objective of this 3-year project was to introduce a new curriculum of international study into an engineering and applied sciences, single-purpose university with the curriculum focus on the social sciences and languages. The basic problem addressed by the project was that the engineering profession is exceptionally international in its cultural extent, yet most students have had no educational preparation in the practical knowledge about broad political, social, economic, and cultural realities of Third World countries and their languages. Included in this report are: (1) an executive summary; (2) the project overview listing objectives, funding, results, and implications; (3) a discussion of the purpose and rationale behind the genesis of this project; (4) a discussion of the background, the origins, and the priorities of this project; (6) a detailed description of this project in terms of curriculum development and international student internships; (7) the results of this project in terms of the evaluation for the extent to which the objectives were met and/or institutionalized; (8) a list of conclusions, the foremost of which emphasized that to build such a program in specific areas of institutional strength and expertise requires careful long-range planning; and (9) appendices which include documents related to curricular development, outside evaluation formats, international internships, and promulgation of project results. (JJK)

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A Curricular Reform and Modernization Proposal for
Internationalizing Engineering Education

PROJECT SUMMARY

The basic objective of this project was to design and implement a curriculum of global studies appropriate to an engineering and applied sciences program at the undergraduate level. FIPSE funds were used primarily for faculty salaries, international travel, and occasional specialized studies designed to meet the project goal. Major project results include: (a) the founding of a new department, Global Systems & Cultures, which houses a faculty with specialties in the social sciences, languages, and culture studies; (b) the implementation of a minor program of study with an underlying Third World focus; and (c) the creation of international internship opportunities in Latin America and Asia/Pacific Rim.

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EXECUTIVE SUMMARY

"A Curricular Reform and Modernization Proposal for Internationalizing Engineering Education"

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A. **Project Overview**. The primary objective of this three-year project was to introduce a new curriculum of international study into an engineering and applied sciences single-purpose university. The new internationalized curriculum was to comprise course work in the social sciences and languages.

Concurrent funding for facets of the program not appropriate for FIPSE grants came from several other outside sources.

Most objectives were met. The new curriculum is now institutionalized in the form of: (1) a new academic department (Global Systems & Cultures); (2) a new minor program (in International Political Economy); and (3) international internships for undergraduate students in Latin America and Asia.

The direct beneficiaries of the project are the undergraduate students. In addition to having the option of choosing an elective minor in International Political Economy, students may also choose to just take an occasional course with the department. These courses fulfill almost all liberal arts graduation requirements for the B.E. and B.S. degrees.

B. **Purpose**. The basic problem addressed by the project was the fact that the engineering profession is an exceptionally international one, and yet most students have no educational preparation for this aspect of their future careers. To illustrate briefly: an estimated eighty percent of all graduates of this institution will work internationally in some sense during their careers.

Curricular content was designed against the backdrop of the university's strength and emphasis on non-renewable natural resources engineering (mineral and energy resources). Most of the world's known supplies of these products is in the Third World. The two regions of the world incorporated into the curriculum during the life of this project were Latin America and Asia. An African/Middle Eastern component is the next planned component.

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Additional curricular concerns included the fact that the institution offers degrees only in engineering and science, with students' majors consuming most of their time and efforts. In other words, the project had a minimal amount of credit-hour space in which to deliver a maximum amount of practical knowledge about broad political, social, economic, cultural realities of the Third World, in addition to some work in a foreign language.

Despite the fact that the new department would be non-degree granting, this "constraint" provided a degree of flexibility from a disciplinary standpoint. While the faculty members of the department have been drawn from a balanced mix of disciplinary backgrounds, the department encourages its faculty to cross disciplinary boundaries at will in search of new and better approaches to their areas of expertise and interest.

Problem redefinition during the course of the project has been more in the form of a deeper understanding of the problem as originally defined. This came about through contact with both industry and alumni during the three years. A couple of the more salient points in this regard are:

(a) Corporations rarely take it upon themselves to prepare employees for international assignments much beyond a day's seminar or a little additional travel in the region.

(b) U.S. multinationals are the least likely type of corporation to be able to provide international internship opportunities, yet want universities to turn out more internationally competent and competitive graduates.

Those considering replicating this model at other universities should be aware that some outcomes may be applicable only to this particular institution; other aspects potentially have broad application, especially with respect to building an international network of contacts and partners and to setting up internships.

C. **Background and Origins**. This project originated in the priorities of a new administration; that is, it was a "top-down" creation. This management style had both positive and negative consequences. The positive outcomes are due largely to one abiding advocate in a mid-level administrative post. Otherwise, even though the program was a stated priority of the administration, this did not mean that the "top" would necessarily go to bat for the program when rough seas were encountered. Nor was the original purpose of the program communicated well to the campus at large prior to its founding. At a small university, this made for an dicey political climate in which to operate.

Thus, the project had to find ways to clarify its mission and assuage misgivings. It also had to demonstrate that it could stand

on its own and pull more than its own weight, all independently of the administration that created it. In short, it had to find ways to be autonomous and to engage in fence-mending even while trying to move the project along.

D. **Project Description**. Curriculum development and setting up international internships were the two main features of this project. Several initial assumptions were made, some of which were proven valid, others of which were not. A summary of these assumptions and what happened to them as the project unfolded are:

(1) No engineering decision is a purely technical one, especially in the Third World. (Still considered valid.)

(2) The new curriculum would have to emphasize the "practical" side of the social sciences and languages which would have more immediate application and relevance for what an engineering professional is likely to encounter. (Still considered valid.)

(3) Faculty members from the engineering and sciences departments needed to participate in the project in ways that would enhance their own international expertise. (Still considered valid; not developed as completely as would have been liked, due to an adverse political situation.)

(4) The project director could become sufficiently conversant in innovations in foreign language training to design an appropriate course of action for the department. (Not valid; an outside consultant was required.)

E. **Project Results**. Most of the objectives were met and institutionalized. Evaluation was one of the most difficult aspects of this program, however, since there was little to measure the project against. Two outside evaluations of the program have been conducted to date, however.

F. **Summary and Conclusions**. This and other recent FIPSE project internationalizing have all reached a similar conclusion, independently of each other: a university that is looking to internationalize is well advised to build such a program in specific areas of institutional strength and expertise. Shotgun approaches are not likely to produce viable results.

G. **Appendices**. Six appendices are included and relate to the following areas: curricular development; outside evaluations; international internships; and dissemination.

PROJECT OVERVIEW

Internationalizing engineering education was one of seven stated priorities of a new administration at Colorado School of Mines in the mid-1980s. The project director of this grant was one of a two-member team hired by the institution to bring about this goal, and the FIPSE proposal was generated shortly thereafter.

Ultimately, the FIPSE grant became the centerpiece funding for the academic aspects of this project. Other aspects of the overall objective were achieved with funding from four additional sources: U.S. Information Agency (three separate grants visiting faculty from Latin American universities); Tinker Foundation (two grants for general operating funds, library acquisitions, and internship assistance); Exxon Education Foundation (general operating funds); and the Pfizer Foundation (library acquisitions). An additional dissemination grant from FIPSE, in conjunction with a FIPSE project at the University of Rhode Island, will cap the project with a national workshop to be held in 1990 on internationalizing engineering education.

In large part, the objectives of the proposal were met. The university now has a new department (Global Systems & Cultures / GS&C) that offers courses in the social sciences with international focus (primarily the Third World, as will be explained below), in languages (both foreign languages and English as a Second/Foreign Language for international students), and in culture studies. For the most part, the faculty of this department is new to the institution, with two exceptions. One original objective of the

proposal, that of studying the possibility of creating a fifth-year program of study, was not addressed due to a mid-level administrative change that brought a strong detractor of the program to power.

The direct beneficiaries of the program are the undergraduate students. The courses offered by the Department of Global Systems & Cultures may be taken either to fulfill liberal arts graduation requirements, or may be applied toward a 21-hour minor in International Political Economy. An additional 3-hour internship option in the minor provides the student with the opportunity to be a practicing engineer or scientist in Latin America or Asia for three months at some point after completing the junior year.

Indirect beneficiaries of the project, including those portions that were not directly funded by FIPSE, were numerous. Without specifying how and why each of the following entities has benefited, suffice it to say that the list comprises: engineering and science faculty participating in the project; the library; admissions recruiters; domestic and foreign enterprises; engineering/applied sciences programs at other universities; foundations and educational associations; Latin American universities; State of Colorado; regional business community; U.S. diplomatic missions.

PURPOSE

Like many other professions in today's global economy, engineering and applied sciences are practiced in an international

environment and are increasingly subject to international competition. This is especially true in the area of non-renewable natural resources engineering (the minerals and energy-related fields), which constitutes the focus of this particular institution. In fact, an estimated eighty percent or more of our graduates will live and/or work outside their own country during their careers. The problem, therefore, was the lack of any cohesive program of study to prepare students for this almost inevitable eventuality.

Further problem definition in terms of future curricular content took into account the nature of the minerals and energy industries at present and for the foreseeable future. Three-fourths of the world's known mineral resources, and some two-thirds of its known energy resources, are located in the Third World. Additionally, seventy percent of all U.S. engineering products and services are now subject to international competition. In light of these facts, it was decided that the primary focus of the new curriculum should be Third World countries. Initially, the program developed a Latin American component; subsequently, an Asian component was initiated later in the project. Post-FIPSE plans call for the addition of an African/Middle Eastern component, and, eventually, the developed capitalist and socialist nations as well, given the integrated nature of the world's economy.

Finally, the original problem definition addressed the "delivery system," as it were, of the proposed curriculum. Two concerns were paramount: One was the fact that at an institution

granting degrees only in engineering and science, the liberal arts comprise only a small percentage of a student's course work. In order to achieve maximum impact within a minimal amount of time, courses would need to be designed in a way that would provided students with a good working knowledge of the macro political, economic, social, and cultural realities of the mineral-and energy-producing regions of the world. No one expected--or expects--our students to be able to bill themselves as international "experts" as a result of this new curriculum. However, we do expect to have provided them with the intellectual direction and tools necessary for self-education in the future, or possibly even to give them a foundation for pursuing graduate work in some related field of study.

The second concern of the "delivery system" that had to be considered was the disciplinary composition of the faculty teaching in the program. Scholars specializing in Third World studies have long been frustrated by the various disciplinary boundaries that have been drawn in the social sciences between, say, political science and sociology, or sociology and economics, for example. These lines have been defined by the realities of the Northwest European tradition of liberal democracy and become very artificial constructs in developing world settings. It was decided early on, therefore, that teaching about the Third World required more appropriate and experimental approaches than are found in universities with fully developed departments of political science, economics, sociology, and so forth. Subsequently, the new

department has sought faculty whose own educational backgrounds are multidisciplinary and who are searching for new avenues of intellectual inquiry into their chosen areas of expertise. Thus, the fact that it was institutionally impossible to have anything but a multidisciplinary department has rendered this project an experiment in innovative approaches to teaching global studies as well. Our faculty members are able to pursue unconventional research designs and teaching methodologies without fear of departmental peer censure for straying out of traditional disciplinary boundaries.

Insofar as there has been redefinition of the problem, it has come in the form of greater insights into the original problem. For instance, we are now aware that most recent graduates who begin their careers in the technical field in which they were trained do not remain in these positions for long. Within seven to ten years, their companies begin moving them out of engineering assignments and into managerial and administrative posts. Conversations with alumni of the early 1980s reveal that these people are now rather frightened: they know they have no educational preparation for these new assignments, yet they also know that their careers will be frozen where they are if they do not take these new assignments when offered. One reason this has become common practice in the business world is because of the rapid rate of technological change. Today's graduate of an engineering/applied sciences program is technologically out of date within about five years, or even less in some fields.

We have also become more familiar with the true weight of the burden that lies with higher education as the main "solution" to this problem. First, one cannot assume that a future employer will do much in the way of orientation prior to an international assignment. A typical corporation is likely to provide little more than a day-long seminar on a particular country before sending an engineer to live there, or an open airline ticket to go traveling about a region on one's own prior to commencing an assignment. Predictably, results have been disastrous. One major oil firm reports having to bring back ninety percent of the American engineers it sends to Southeast Asia within less than a year because of their inability to adapt, either professionally or personally.

An added frustration in putting together this program of study so as to make our graduates more competent and competitive internationally lies with industry. One of the realized objectives of the project, as noted above, was the establishment of internships abroad. Time and again, however, it was the U.S.-based corporation that was least in a position to assist in bringing about these opportunities. While they support and welcome the idea, their hands are often tied by the local political and economic constraints where a subsidiary operates; ultimately, it is easier to bow out of the process altogether rather than work to find ways around the problems. By contrast, in our experience it has been the nationally-owned private or state-owned enterprise in Third World countries that has found ways to make the internship

program a reality. Some see the opportunity as an inexpensive way to transfer technology; others as a way of providing a cross-cultural work environment that will benefit their nationals who often have to work with foreigners. Thus, there is an irony here: it is the U.S. business community that demands more internationally competent employees and looks to higher education to furnish them; but it is also the U.S. business community that cannot be of much help abroad in making experiential learning a reality, at least for some professions and in some settings.

While we know that some facets of the model we have developed are transferrable to other universities and other disciplines, there are features of this project that in all likelihood would be extremely difficult to replicate elsewhere; founding a new department populated by scholars from several disciplinary backgrounds is probably foremost among them. At a more traditionally structured university, such a move would cause innumerable administrative problems in term of tenure, promotion, evaluation, and so forth. Again, the fact that this program is housed in a non-degree granting department provides a latitude in this respect that would likely be too great an obstacle to overcome in a more conventional setting.

Other aspects of the model could readily be duplicated, provided a prospective project is able to identify faculty who are eager to make a multi- or interdisciplinary program something more than a menu of courses from several departments. A recent example comes from the University of Montana, now engaged in a FIPSE

project in international natural resources management that combines foreign language, natural resource study, and forestry. In conversations with its project directors, the areas of greatest relevance for them from this project had to do with (1) setting up internships abroad; (2) establishing a profile and projection of future directions of the forestry industry worldwide, including the sensitive areas of environment and political economy; (3) making appropriate international contacts; and (3) identifying and seeking sources of simultaneous funding for other aspects of the project not covered by FIPSE funding.

BACKGROUND AND ORIGINS

As noted above, this project was the an outgrowth of a new administration that identified "internationalizing" as one of seven priority areas. In other words, this was very much a "top-down" creation from the beginning. In reflecting back on the project, it is obvious that this format can be both advantageous and disadvantageous to the course of a project. A brief history of the progression of the relationship between the top level administration of the institution and this project will illustrate these pluses and minuses.

First, it is important to be aware of the relatively small size of this state-supported institution: about 2,500 undergraduate and graduate students combined, with around 300 full-time faculty. While these numbers make this a "small" university, they are "large" in terms of the size of engineering programs nationally. Furthermore, as noted above, the institution does not

grant a degree in the liberal arts. This environment held out two advantages for the project at hand. First, there were not multiple layers of a bureaucracy to work one's way through; consequently, many things moved along rather quickly, especially earlier on in the project. Second, since any academic program resulting from the project would not be degree-granting, a large measure of creativity could go into the design of the curriculum and faculty staffing.

On the negative side, however, a small institution is not unlike a small town: everyone knows everyone else's business and feels like it is theirs, too. Personalities, preferences, and prejudices get in the way of decision making to a greater degree in such a setting. As the two faculty hired by the university to bring about an internationalization of engineering education soon discovered, communication between the top administration and the "community" was poor. Evidently, the "community" had not been consulted to any appreciable degree about the introduction of a new program. Instead, the program was viewed as an imposition from above. Furthermore, in a time of increasing budgetary problems, the need for something new that lay outside the mainstream of the institution's primary purpose was not readily apparent to many. Nor was there a clear understanding of the purpose of the initiative. Many engineering and science faculty members assumed that "internationalizing" meant creating a clearinghouse where they could go and say "what kind of consulting job do you have for me in Country X?"

In time, it also became evident that not too many people in the administration knew what "internationalizing" meant, either. Whereas the two faculty hired to carry out this directive had a very clear understanding of the problem at hand and how they wanted to go about addressing it, such was not always the case among those who brought the program into being. As one grant proposal after another was successfully funded, the silence from the top was deafening: all of these monies were restricted to specific activities; where was the university's cut, its unrestricted funds to do with as it pleased? If "internationalizing" is "in," then surely there must be some big bucks out there just for the asking; the educational value was of rather secondary consequence. At least, this has become the perception of the administration's attitude over time by those closely involved with this project.

Fortunately, one mid-echelon administrator has cared about the academic dimension of the project from its inception and is largely responsible for seeing through many of the successes of this project in that regard. It is because of his abiding interest and active involvement that the project became institutionalized very quickly. By the end of the first year, a minor program of study had received Board of Trustee approval. Toward the middle of the second year, a new department in which to house the minor was likewise approved. The project director seriously doubts that these major steps could have been accomplished in as short a time if this had been a grassroots project working its way upward through the system.

But even a top-down management style is no guarantee of realizing every objective. As noted earlier, one aspect of the project included in the original proposal that was never addressed was the possibility of developing a fifth-year program of study. Fifth-year scenarios are not a new idea in engineering education, and there are several engineering programs that have been experimenting with them. Often, they involve an area of study outside the student's engineering major (not unusually in the liberal arts) and may well be dual degree programs. At the outset, this project envisioned participating in that experimenting, using global studies as the second field. Exactly what would constitute that fifth year--its mechanics, its objectives, its degrees, even its potential viability--were all issues that the institution needed to be involved in as a whole. Unfortunately, the new administrator selected to chair the committee holds the whole internationalizing effort and program in contempt and successfully stalled the committee appointed to study the question. Said committee was not appointed until late into the second year of the project and met all of one time. It was at this point that it became increasingly clear to the project director that the top-level administration's commitment to internationalizing was there as long as those implementing it were moving along nicely under their own steam, but that it was not so important as to go to bat for it when the administration itself would have to get too deeply involved in a controversy.

Two strategies on the part of the program's implementors probably account for much of the project's overall and continuing success. First and foremost has been the ability to attract additional outside support for aspects of the program that are not appropriate to FIPSE funding. These sources and the nature of their support are noted in the "Project Overview" section above and need not be repeated here. Two of the seven other grants were awarded only a month or two before the FIPSE grant; a third came along shortly thereafter; two more followed during the second year of the FIPSE project; a sixth was secured in the third year of the grant; and a seventh has just commenced as the FIPSE grant has expired. All are multi-year awards. With these sources, the program has been able to give itself a strong identity and, more importantly, a significant degree of autonomy. In fact, the institution supports less than half of the total operation at present. Currently, new avenues of future financing are being explored and acted upon. For instance, the faculty members of the department will soon be embarking on the production of a quarterly newsletter for corporations that offers executives a "second opinion" on key international issues. And, at its most ambitious, the program is exploring ways in which the lion's share of the whole operation can be privatized.

This autonomy, in turn, has meant that the program can still be the master of much of its own destiny in terms of on-going innovativeness and creativity, and that it does not find itself in a dependent relationship with the administration that gave the

program impetus. The program implementors now try to maintain ties with superiors that can be tightened or loosened as the political climate shifts. Concurrently, the program's autonomy and strength have also made it possible to engage in building good working relations with most of those departments on campus that were leery, skeptical, opposed, or at best lukewarm to the international effort initially. Many faculty members now believe that this new program is "one of the most exciting things going on" at the university.

A final word on the potential pitfalls of a project that is the by-product of a top-down management style: the top just might disappear on you. Last spring, the same president that made internationalizing a priority of his administration was the focal point of a vote of no confidence. The subsequent response from the top has been to engage in major administrative and academic restructuring all at once. Fortunately for this project, these upheavals have occurred towards the very end of the grant period. While one hopes that most FIPSE project directors will never have to find themselves caught in the middle of similar circumstances, it is worth noting that the average length of a university president's term in office at any given institution these days is a sobering three-and-a-half years.

PROJECT DESCRIPTION

The main features of this project included the development of an appropriate curriculum of global study and the setting up of internship opportunities abroad. Each will be discussed in a

separate subsection.

Curriculum Development. This project proceeded from the basic assumption that no engineering decision is a purely technical one, and that this is especially true in the Third World. Politics and economics invariably intervene and often wield greater influence over a given project than any technical consideration. While engineers tend to "know" that this is true, they do not usually have the intellectual foundations or knowledge base to understand why this is the case, much less how to analyze or compensate for it in their professional behavior and decision-making.

Operating from this assumption, it was readily apparent that the social science courses to be included in the new curriculum needed to have a strong "practical" as opposed to theoretical dimension to them--a working, hands-on, applied approach, if you will. We also assumed that the internationalizing effort needed to have expression elsewhere on campus, outside of the particular program we were developing. If faculty members from other departments could also become more literate about how the engineering profession is practiced in Third World settings, then students would be able to develop an even better sense of the confluence of the social sciences and engineering in the real world.

To this end, we utilized part of the FIPSE funds to send faculty from the departments of metallurgy, mineral economics, environmental sciences and ecology engineering, and geophysics abroad for short periods and to offset the cost of substitutes in

their absence. In most instances, these professors were visiting sites relevant to their own specialties that they had only read about but had never seen. New areas of research were opened up to them, and their classroom presentations of the material became more vivid and "real."

The project originally envisioned that a great deal of this type of activity would take place toward the end of the project, especially after some fifth-year scheme had been fleshed out. A set of faculty to participate in such a program would then have a clearer idea of what their overseas agendas were to be. Unfortunately, since the fifth-year issue was never seriously addressed, this part of the project never reached full maturity. At project's end, however, the original assumption about engineering decisions has been reinforced time and again and thus remains an integral part of the program's raison d'etre.

On the positive side, however, the collaboration with those professors who did travel in the project's behalf laid the groundwork for more formal cooperation on campus. For example, the Department of Global Systems & Cultures will soon be participating in a new "international track" in environmental sciences at the master's level. Likewise, GS&C faculty are being invited to participate in thesis and dissertation committees in the mineral economics department predicated almost exclusively on U.S. realities) when topics arise in our area of expertise.

A second assumption made about curriculum development was that

the project director would be able to bring herself up to speed on what is current in foreign language training, both pedagogically and in terms of technological advances in language lab equipment and environment. This assumption proved to be entirely erroneous. Ultimately, some FIPSE funds were expended on a consultant who did an extensive study of what is now available on the technical side, what the needs of this program are and will be, and what are the most appropriate options for our particular situation. This study will form the basis of future proposals for the language portion of the program. In addition, the project director attended several national conferences devoted to foreign language instruction and was able on one occasion to have one of the department's language professors accompany her. As the project ends, future needs and directions in foreign language teaching will now be able to be articulated and planned far more realistically.

Internships. By far, the most time-consuming and costly part of this project was in the establishment of internship opportunities in Latin America and Asia. This segment of the project is the subject of a special document being prepared for FIPSE in conjunction with FIPSE projects and the University of Rhode Island and Edmonds Community College (Washington state). For that reason, an elaboration of this effort will not be included here. Some basic assumptions and conclusions are in order, however.

From the outset of the project, there were three key

assumptions made about internships. First, that they were one of the most desireable ways in which to bring a student's course work in both his or her technical field and in global studies together in a real world setting. Second, that we would not settle for anything less than a hands-on internship: no licking envelopes and running errands in a nice office at corporate headquarters. And finally, if these internships were to be set up right, we would have to do the work ourselves.

The last point is a particularly important one. Any institution that thinks it can put together such opportunities by sending a faculty member abroad to visit here and there, or get in touch with the local U.S. diplomatic mission in a given country, or pay a visit to the corporate headquarters of a U.S. multinational to make arrangements at subsidiaries around the world will be sorely disappointed. Embassies and consulates will be verbally supportive and can sometimes assist with appointments but are otherwise too busy and too short of staff to go much further. Actual sites must be visited, oftentimes more than once or twice. Envoys sent out on such missions must be more than passingly conversant with the political, economic, and cultural realities of the target country. Requests from potential sponsors for some kind of reciprocity must be anticipated and planned for. Frequent communication must be maintained once back home. Technical difficulties and the added expense of international communication has to be taken into account as well. Finally, an enormous amount of time will be spent on each student's case before an opportunity

becomes reality. These points and others will be covered in greater depth in the document referred to above.

PROJECT RESULTS

In many respects, the effects of this project on its participants, on the institution, and on cooperating organizations are difficult to assess. The project director herself has grown professionally as an educator in ways that are too numerous and complex to mention. Sadly enough for the future of the program, two of the project's participants from an engineering department have decided to leave the university altogether for careers in the business world. One confided to us that the one thing that almost held him back from leaving was our new program and the prospect for his continuing participation in it.

The more tangible results of the project on the institution itself have already been mentioned in several places above: the creation of a new department that is delivering a new curriculum to any student with an interest in global studies; the creation of a minor program that has about thirty or so students participating; and the creation of international internships.

But there are intangibles as well. An engineering and science faculty that traditionally had little regard for the liberal arts is becoming more and more convinced of the necessity of the program. Recruiters have found a new selling point. The library now has something to live for. Alumni have taken notice and nod approvingly. And as for other organizations that have cooperated

with us, especially through the internship portion of the project, it is far to early to draw any conclusions.

In fact, the nature of this project has been such that it does not lend itself readily to evaluative measures. Against what does one measure that for which there is no precedent, no standard? The most telling evaluation of the program is yet to come--when we begin to have our students out working in the real world. Will their background in global studies be noticed by recruiters? Will their career paths within a corporation depart from the norm? Will they make any difference in the ability of a company to be internationally competitive? Future evaluation plans call for staying in touch with our alumni and tracking their professional lives.

The project has been evaluated by one outside observer (a faculty member at another university) and by a "visiting committee." The latter is a creation of the institution: every department has a visiting committee comprised of educators, foundation representatives, industry representatives, and alumni who review a department's progress annually. After waiting for months to have the composition of our committee finalized (due to the fact that the file had been lost by the administrator charged with the task, it was discovered later), the visiting committee for Global Systems & Cultures finally convened for the first time this past September. Although the committee's charge was to evaluate all aspects of the program (not just that portion funded by FIPSE), a great deal of what that program is today is a direct result of

the FIPSE grant. A copy of both evaluations can be found in the appendices.

With respect to dissemination, this project has been awarded a dissemination grant that will put together a national workshop to identify and discuss many issues that have arisen in the course of this project that come to bear on engineering education as it is practiced in this country. The dissemination project will be co-sponsored by this project and a German language cum engineering FIPSE project at the University of Rhode Island. Participants will come from other university engineering programs, industry, various branches of the U.S. government (Departments of Education, State, and Commerce), and educational foundations.

Immediately foreseeable dissemination activities include the internship document referred to above, and a solicited article on the program to appear in a new mining news publication entitled Mining World News (Reno, Nevada).

SUMMARY AND CONCLUSIONS

One "umbrella" assumption that was made at the outset of this project that has not been discussed previously in this report merits mention as a concluding point. That assumption was that the project to internationalize engineering education needed to draw on the institution's inherent strengths and foci. In other words, we needed always to be mindful of the natural resources engineering and applied sciences context in which we were operating. In theory, we could have just as easily devised a curriculum focusing

primarily on U.S. foreign policy and still have claimed to have done something international. It would not have been appropriate to the setting, however. Over three years later, we are still convinced of the validity of that assumption.

More importantly, though, our conclusion has been borne out by other, recent FIPSE projects with internationalizing objectives. Directors of future projects involving international study must be aware of the complexity of putting together sound, coherent programs. As such, our opinion and that of several other project directors is that it is far wiser to identify one's areas of expertise as an institution rather than to take a cafeteria approach to internationalizing that tries to involve and permeate a broad spectrum of departments and disciplines.

A few final, abstract thoughts for those projects aiming to "go global." The global economy and world order are in a state of rapid change; educational institutions rarely move at such speeds. Given these facts, one can expect that the response to demands for more globally competent graduates of institutions of higher education will proceed in incremental and somewhat disjointed ways. In the course of this process, however, imaginative, inventive, unorthodox approaches should be encouraged if we are to survive and thrive in--to borrow a phrase from Mahler--the ceaseless motion of these fluid times in the world's affairs.

Grantee Organization:

Colorado School of Mines
Latin American Center for Minerals
and Energy Development
Golden, CO 80401

Grant No.:

G008642167

Project Dates:

Starting Date:	September 1, 1986
Ending Date:	August 31, 1989
Number of months:	36

Project Director:

Laura J. Pang
Latin American Center for Minerals and Energy
Development
and
Department of Global Systems & Cultures
Colorado School of Mines
Golden, CO 80401
Telephone: (303) 273-3595

FIPSE Program Officer:

Sandra Newkirk

Grant Award:

Year 1:	$57,052
Year 2:	$61,806
Year 3:	$54,853
Total:	$173,711

APPENDICES

Curriculum Development

1. Current Structure of the Minor and Certificate in International Political Economy

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4. Summer 1989 Trip Report [Hong Kong, People's Republic of China, and the Philippines], by Gaye Christoffersen

5. Promoting Linkage Agreements for CSM: Report on Trip to Indonesia and Malaysia, by James Jesudason

Dissemination Sample

6. "How to Design an International Engineer," The Mines Magazine (circulation: 5,500), February 1989.

APPENDIX 1

Current Structure of the Minor and Certificate in International Political Economy

CURRENT STRUCTURE OF MINOR AND CERTIFICATE IN INTERNATIONAL POLITICAL ECONOMY

Department of Global Systems & Cultures

		Credit Hours
Crossroads	Freshman-level introductory humanities course required of all undergraduates taught by Dept. of Humanities & Social Sciences	3
Foreign Language	Two semesters in one language appropriate to area of concentration (Latin America or Asia) Three semesters of each of the following languages are currently being offered: Latin America: Portuguese, Spanish Asia: Indonesian, Japanese, Chinese (approved but not yet offered)	6
Area Survey (Junior Level)	Either: Political Economy of Latin America Or: Political Economy of Asia	3

Seminar with an Area Focus (Senior Level)	Latin America
	* Modernization and Dependency in Latin America
	* Parastatals and Economic Development in Latin America
	* Special Topics: varies each semester; to date has included:
	  * Contemporary Writers of Chile
	  * Amazon Development and Under-development
	  * Contemporary Brazilian and U.S. Writers
	  * Comparative Cultures of Latin America and the United States
		3

IPE Minor and Certificate, cont'd

Seminar with an Area Focus, cont'd	Asia	(3)

	* Social and Political Change in Asia
	* Comparative Modernization in Asia
	* Special Topics: varies each semester; to date has included:
	  * U.S. Foreign Policy in Asia
	  * Political Economy of Ethnicity in Asia	

Seminar with a Global Focus (Senior Level)	* Revolution in the Third World
	* Critical Issues in World Affairs
	* Global Environmental Issues
	* Cultural Dynamics of Global Development
	* Managing Cultural Differences
	* Special Topics: varies each semester; to date has included:
	  * International Energy Relations
	  * Comparative Third World Development: Successes and Failures
		3

IPE Exit Seminar (Senior Level)	Required of all IPE minors; focus on a current international issue of relevance to Third World mineral- and energy-producing countries	3
		21
International Field Practicum (Senior Level)	The addition of this internship abroad is the one course that differentiates the IPE minor (21 hours) from the certificate (24 hours).	3
		24

APPENDIX 2

Draft Report on Global Systems and Cultures Program at the Colorado School of Mines

MAY 0 2 1988

DRAFT REPORT ON GLOBAL SYSTEMS AND CULTURES PROGRAM AT THE COLORADO SCHOOL OF MINES

In the course of two days I spoke with more than twenty faculty and administrators regarding this program, and we covered topics ranging from overseas research to undergraduate curriculum. I also had a chance to read background material before arriving. I was strongly impressed with the progress made in a short time and with the enthusiasm of most participants. I was pleased to be asked to conduct this informal evaluation; I learned a great deal and met some fine faculty. The following observations are no more than an outsider's impressions, which may have a little utility in planning the future of the program.

I found universal agreement with the concept of formalizing and featuring an international component in the CSM curriculum. Faculty and students have always had global connections, and the school should build on these resources. Students can be trained to operate more efficiently in overseas jobs. Alumni who have worked abroad can make a larger contribution to the school. Research grants for international projects, whether in traditional departments or in newer fields, will bring in fresh money. And because its student body is relatively small, CSM can probably accomplish these goals more easily than a larger institution.

Most persons I spoke with agreed that the days of "individual enterprise," wherein each faculty member maintained a set of contacts in industry and consulted on his or her own, were gone. CSM now has a commitment to and a body of experience in international studies, and effectiveness requires teamwork. The school depends on overhead from sponsored research. Moreover, graduates need skills beyond strictly technical training in order to climb the management ladder in multinational businesses.

There was less agreement on exactly what elements should comprise the international program. Some activities, like faculty exchanges and student internships abroad, require much staff work, money, and delicate arrangement. Others, such as undergraduate courses in area studies, are being accomplished by restructuring the curriculum and adding a few new instructors. Availability of funding, faculty cooperation, and chance opportunity all affect the choice of areas to stress. It might be helpful to list the many program components, group them into categories (e.g. research, undergraduate and graduate instruction, faculty development, networking abroad), and then rank them as to priority.

The pace of expansion also elicits differing opinions. Some want to see the program accelerated, others would prefer it slowed. I think that it should probably move forward as quickly as possible, because it has been in gestation for a long time and has now gathered momentum critical for continued success. The new professor in Asian

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studies will help give the unit the coverage promised in the term "global."

A central instructional issue seemed to be the student stratum most likely to take and benefit from international courses. Undergraduates have very few elective hours for courses outside their majors, and their chief desire (according to faculty) is to graduate and begin earning money. Therefore, the service approach taken thus far, offering area studies and language courses complementary to engineering careers, makes sense.

As for major study, however, the MA level might be a more logical place to emphasize. The program could attract mid-career professionals and graduates with management aspirations. Corporations could sponsor their people and perhaps help endow the program. Retired executives with international experience could be invited to spend a semester at CSM as "management emeriti" who would teach seminars and tutor students.

As time goes on, more and more professors will probably volunteer to work in the international programs, in exchanges, short courses, organized research, student recruitment, and team consulting. Some preparation course might be devised for faculty who need a quick orientation, especially regarding effectiveness in Third World countries. This effort could be developed in conjunction with the professional development program on campus or it could be farmed out, by sponsoring participants in such courses at other institutions.

In sum, I found Global Systems and Cultures to be built on sound pedagogical foundations; to have good faculty support; to meet the needs of a medium-sized engineering university; and to offer a high probability of successful expansion in the future.

APPENDIX 3

Visiting Committee Report on
Department of Global Systems & Cultures (First Report)

John D. Wirth
Provost's Office
Stanford, CA 94305
10/31/89

COLORADO SCHOOL OF MINES
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GOLDEN, COLORADO

Visiting Committee Report
On Department of Global Systems and Cultures
(First Report)

The Visiting Committee consisting of Milton Drucker, Roger Eldridge, Marvin Gantz, Ian Mackay, Renate Rennie, Philip Walsh and John Wirth, Chairman, met in Golden for two days on September 19-21. Alejandro Bulgheroni and Martha Muse were unable to attend.

This was the Committee's first meeting in a three year charge to examine and report on the new Department of Global Systems and Cultures (GSC) and related international programs at the Colorado School of Mines. Our overall impression is that the School has successfully taken the first steps to internationalize its curriculum, and that it is now time for GSC and related programs to become more institutionalized with respect to course offerings, areas covered and integration with other programs and departments. Dynamic leadership under the Pangs, coupled with support from the higher administration, has produced good results. The challenge, now, is to manage that success in order to develop a durable and more systematic program.

Within an overall context of rapid change, tight resources and severe time constraints, GSC has carved a viable, necessary, and still rather precarious niche for itself in the overall curriculum. In a school still dominated by traditional departments, not all faculty have bought into the interdisciplinary approach, although we sensed that there was broad support, in general, for the need to think internationally. This is perhaps especially marked in students and junior faculty, something we will want to examine in future visits. But on the basis of our first visit we can say that in the competition for funds and curricular space GSC needs advocacy and protection.

With this in mind we recommend,

1. That in the current review of requirements for graduation, GSC and related programs not be asked to give up curricular space.

2. That the reporting system whereby all departments, including non-degree granting ones like GSC must compete for access to the Academic Vice President be modified. Mines should consider bringing in a Dean to oversee international programs, Humanities & Social Sciences, and the MacBride Program, with direct access to senior administrators.

Our second set of observations concerns the curriculum and program offerings. For the most part, the Committee will limit itself for now to a set of questions for Eul and his colleagues, until we become more familiar with courses and programs.

Much has been accomplished in very short order. However, it is clear that GSC should devise ways to make more effective use of existing resources at Mines and to better coordinate its courses with offerings in Mineral Sciences, in the teaching of basic economics for example, and with Humanities and Social Sciences. How could this be done? Through the merging of departments, and/or the creation of a coordinated division (which is perhaps implicit in our recommendation above)?

And, if coordination is the order of the day, with growth still desirable but difficult to sustain, what in your view are the critical faculty hires and (especially) replacements?

The addition of an African/Middle Eastern component might make sense down the road, but we are concerned the CSC and the new International Institute could spread itself too thin. Would it make more sense to bolster the Asian Studies component, perhaps in conjunction with Colorado University, while continuing the emphasis on Latin America? This would play to faculty strengths, in both social science and language instruction, while opening the School to closer links with Japan. The buildup of library resources to support instruction in these two world areas is both commendable and necessary.

A related question concerns Mexico, which is lightly covered if at all in the curriculum, and Canada, the source of many graduates. Given the rapid integration of North America as an emerging world region, would a North American component make sense if existing faculty could be used, emphasizing resource and resource-related issues?

The Committee is impressed by the way Third World perspectives have been brought to Mines through GSC with its area studies approach, in which the disciplines of history, political science and sociology are well represented in program faculty. Since much of the curriculum centers on issues of political economy, we would ask how the development economist's perspective can be incorporated as well, perhaps by using existing faculty in other departments. In other words, would this be a good place to implement President Ansell's desire for "cross-utilization" of existing faculty?

In the interviews, we learned that GSC faculty are considering the possibility of offering graduate instruction, perhaps offered jointly with other departments. Would this be a fruitful way to implement the cross-utilization concept? What courses are being considered, what departments are involved, and what would be the timing?

Language instruction is critical to bringing international perspectives to Mines and to preparing graduates for an ever more globalized work environment. However, we note that the School has no language laboratory and that some (but not all) of the language instruction offered is by non-specialists on soft money. To the Committee, this is but a stop-gap measure. Sooner rather than later the School will have to decide which languages have priority, and then seek ways to build this instruction into the regular budget. What, then, are the priority languages as of now?

The internship program administered by Laura Pang is an attractive option for students at Mines, which unlike competitors in the same league does not offer a foreign studies option. The Committee is impressed with this program, and thinks it can grow rapidly and has excellent donor appeal. However, it is inherently labor intensive, and rapid growth in this area would soon require additional staff. We say this, noting that internships are one area of the program that is ripe for a well-targeted and sustained fundraising program.

Another way to provide foreign experience is through exchange, and with this in mind the pending agreement with Loeben should be encouraged, and with it the possibility of obtaining Austrian private and foundation support. Similar agreements with comparable schools elsewhere may be possible, and we would like the faculty to consider how such agreements and exchanges could best be used to further the goal of internationalizing the curriculum.

A related point concerns foreign students at Mines, a resource currently untapped in any systematic way. Imaginative and appropriate ways to incorporate their energies and perspectives could enrich the curriculum, while sowing the seeds for future fundraising abroad. And, as the U.S. itself moves toward a more multi-cultural society, we would like the faculty to speculate on how the growing minority student population at Mines can take full advantage of the international programs and perspectives now being introduced.

And, a final question about curriculum and programs: the new IBM grant will have a large impact on the School at large. How can this major opportunity be incorporated into the domain of GSC and related programs, as well?

In conclusion, the Committee enjoyed a most stimulating two days. The briefing book was excellent, and we had ample time to explore ideas with a range of faculty. This followed an informative dinner with President Ansell; we then closed with an oral report to Vice President Golden. Our charge is to question and advise, but not to intrude. We appreciate the candor and forthcoming attitude in everyone we met and look forward to working together with faculty, administrators and trustees at this proud and distinguished institution.

APPENDIX 4

Summer 1989 Trip Report
[Hong Kong, People's Republic of China, and the Philippines]
by Gaye Christoffersen

→LAMRA

GAYE CHRISTOFFERSEN

SUMMER 1989 TRIP REPORT

June 30: paper presented at **Asian Studies on the Pacific Coast**, titled "Socialist Integration into the Asian-Pacific Political Economy," Honolulu.

July 3: flight to Hong Kong, arrive July 4, PM.

July 5, AM: Mr. Stephen Hui, CSM alumni. Meeting suggestd by Alumni Association. Primarily a courtesy visit. Mr. Hui has a mining project in Hong Kong's New Territories. Agreeable to CSM students working in it, but right now at exploration stage. Hui needs a followup letter; materials on field practicum and Asia-Pacific Rim Center.

PM: Dr. **Frances Lai Fung-Wai, Director, Centre for Asian Pacific Studies and Dean, Faculty of Social Sciences, Lingnan College.** (former EWC participant) This center is the only one in Hong Kong that focuses on the Pacific Rim; all others focus on China. Dr. Lai's center very active in organizing conferences for industry and academia, and developing linkages for Hong Kong with S.E. Asia and Japan. Could be CSM Hong Kong contact, will eventually have guesthouses for visiting scholars, always cheaper than hotels. Need followup letter with linkage agreement and materials on CSM and A-PR center. Has students intersted in min. econ.

July 6: meeting with Mr. Bernd Knoll, Hong Kong consultant to the oil industry. (consultant for EWC China Energy Study). He briefed me on Pearl River situation.

July 7: Shekou, Shenzhen, base for Pearl River operations.

Mr. Vern Plummer, Administrative Manager, Amoco Orient. Mr. Plummer was exceptionally helpful and responsive to the idea of CSM student field practicum, pending approval from headquarters. Amoco drilling at 1,000 feet which is expensive for now. Internships would be 2 years away if they are still there and the price of oil is up. Staff housing would be available if their Pearl River operation continues.

ACT (Agip, Chevron, Texaco), Mr. Andrew Sammarco and Mr. Michael Hughes. ACT has just finished exploration and was starting production. They were polite but very busy. ACT is only company with significant find in Pearl River. Negative response on field practicum because:
-no staff housing for students
-they are shorthanded now for expats; a student would have to be assigned to someone and no one had time for that.
-they don't send petroleum engineers abroad until after 5 years of domestic experience. They said they never send a novice and didn't think he/she could handle it.
-Chinese partner would not like ACT training U.S. students. ACT

obligated to train Chinese nationals and had more than they wanted.

Esso China Ltd. This company only did exploration, not production. Had no need for petroleum engineers. Used geologists but only wnated experienced ones. In any case may be pulling out of Pearl River. Negative response.

Occidental. Spoke with office administrator, all managers out of the office. In any case, no activity, probably will pull out.

Pearl River Oil Operating Co. (Japex, Texaco, Huanan, a U.S.-Japan-China consortium inherited from Getty Oil) R. Knud Bjornestad, President and General Manager, and Joseph Bochatey, Jr., Drilling Superintendent. Bjornestad responded positively; felt the industry had an obligation to help students get experience. The field practicum would be possible next summer:
-If Pearl River Oil still around by next year. May be dissolved if nothing found.
-If Japanese partners and headquarters agree. He discussed at length the difficulties of a multi-cultural consortium at the operational level: language barriers, different work styles and management styles, incompatible decision making criteria.
-If legal problems not difficult; concerned with company's legal liability.
Bjornestad has long experience in Far East and Middle East and is amenable to nurturing young engineering students, giving them the benefit of his experience. A good contact at Texaco no matter where he ends up.
Joe Bochatey also responded positively partly because he's a CSM alumni. He will be moving on to Amoco Orient in a few months. A good contact when there.

Shekou visit. Overall, everyone extraordinarily congenial and happy for the diversion. All bored except ACT. All the women and children had been evacuated from Shekou right after the Tiananmen Massacre. Seems no one returned to Shekou (called "snakepit" by expats, a loose translation), even after the emergency passed. Shekou had no problems related to the massacre. Shekou office buildings all had great views of the sea and bay. Shekou 1 hour hovercraft ride from Hong Kong with some companies in buildings next to the dock. Visitors must go through PRC immigration. Visa issued good for 5 days.

Amoco Orient seems the best prospect given Mr. Plummer's positive response and the fact Joe Bochatey will be there soon. Negative responses from companies useful feedback to assess companies' calculus in accepting/rejecting interns.

July 9: flight to Beijing. Afternoon and evening spent riding bus around town to assess situation under martial law. Saw more than

I wanted to of the night terror.

July 10: meeting with **Mr. Tim Brennand, Chief Executive, Shell Companies of China and Hong Kong and Managing Director of Shell Exploration (China) Ltd.** (met him at EWC conference on Chinese Energy) Shell has no operational upstream responsibilities now. In the future would be involved in downstream operations if the investment and foreign loan situation could be worked out in the wake of the Tiananmen Massacre. Brennand had worked out Shell funding of PRC students at the Chinese University of Hong Kong who would eventually work for Shell. Responsive to the notion that perhaps the Chinese University of Hong Kong would not prepare them sufficiently in technical areas and further training might be necessary at CSM. Needs followup letter and CSM materials.

July 11 AM: **Mr. Zhao Shengzhen, Vice Chairman, Consultative Committee, China National Offshore Oil Corp.** (met him at Dorothea El Malakh's international oil meeting). Long meeting. CNOOC had financed several dozen students to study in U.S., 50% of whom had not returned to China. This was before Tiananmen Massacre. Percentage could be higher now. Therefore, Chinese educational policy had changed regarding sending students to the U.S., although Mr. Zhao agreed that the U.S. was still desireable for studying offshore petroleum engineering.

Discussion of CSM student field practicum at CNOOC was carried out in the context of developing overall relations between CNOOC and CSM. Mr. Zhao agreed that the summer internships were not only of immediate practical benefit to American students but also benefitted young Chinese as the Chinese and Americans learned to work together, and developed compatible work styles and attitudes. He acknowledged that for most joint ventures in China this is the major problem. (we were both thinking about experience of Pearl River operations but neither spoke directly on that). This tact addressed the major Chinese reservation to American students gaining practical experience in China: that they would prefer to see young Chinese benefit from training in these joint ventures, and that this was part of the joint venture agreement. Zhao was amenable to the suggestion that these young Chinese needed not only technical training but also practical experience in international work environments and that CSM students working side by side with them provided that, i.e., the benefits of a summer internship did not accrue only to the Americans, and that it was better to develop compatible work styles at a young age rather than wait till they were in their later 30's or 40's. Understood in this context, Zhao said he would make a favorable recommendation to the personnel committee of CNOOC regarding CSM student summer internships in joint ventures. Specific applications would still have to be made through individual international oil companies but CNOOC would not raise objections to it in their joint management sessions.

Zhao was also interested in sending young Chinese from CNOOC to CSM but CNOOC faced severe foreign exchange problems in the wake of the Tiananmen Massacre. Interested in the possibility of work-study

for Chinese students. Needs materials on CSM programs. CNOOC probably has more foreign exchange than many other Chinese organizations. We also discussed Xinjiang exploration and development plans.

July 11 PM: meeting with **Mr. Wu Deqi, Director of Information Center, China National Petroleum Corporation and Mr. Sun Xiansheng.** (former sponsor of my research in 1986) Definitely wanted to be my host organization for this trip, arrange meetings, buy statistical yearbooks, etc. This had not been arranged beforehand because of the uncertainty of the situation and final decision to go to Beijing made in Hong Kong. I also wanted to keep it very informal in order to avoid formal meetings or anything that appeared I or CSM endorsed present repressive regime. It was understood that all future arrangements contingent on martial law being lifted before CSM students would go to China.

Explained CSM field practicum to them. Responsive but uncertain as to logistical difficulties. Willing to work it out in the context of improving overall relations between CNPC and CSM. They had a special request that a Mr. Wang Wenxiang be admitted to CSM as a visiting scholar for 1 or 2 semesters to study well logging. CNPC had an immediate need for him to do that. He was fully funded and would not pursue a degree.

Regarding Southwest Petroleum Institute in Sichuan, they thought it better to wait till next year to establish a linkage agreement with CSM. By then, foreign exchange situation would be better. Mr. Wu Deqi would accompany me to visit that institute in Sichuan next time I came to China.

July 11 evening: dinner with old friend and mentor from Chinese Academy of Social Sciences. Situation serious.

July 12: train to Harbin, arrive July 13. Host: **Mr. Han Zhigang, Director of Applied Mathematics Institute, Heilongjiang University,** Economic advisor to Heilongjiang Province. Purpose of visit to explain why USIA had rejected our application under the University Affiliations program. He wasn't surprised. He suggested that if I should come next year to study energy and the economy of Heilongjiang (this year was too unsettled for me and time too short), and all American funding was still withheld, his institute would fund me for in-country costs (Renminbi only). It is relatively wealthy given the work it does for the provincial government and many organziations such as SINOPEC and Daqing oil field.

July 14: Long meeting with his institute's researchers and students to explain CSM, my research on Asian-Pacific energy relations, USIA funding, U.S. foreign policy in Asia, Northeast Asian foreign relations, etc. They don't often get American visitors up there.

July 15: A trip to Daqing in the Institute's new Toyota Landcruiser, a very long trip. Met Han's colleagues at the Daqing

Petroleum Management Bureau, also visited exhibit hall, and warehouse where the first promising core samples taken from Daqing in 1959 are stored. Saw all the millions of core samples ever taken from Daqing.

July 16: lunch with officials from local county.

July 17: AM: meeting with Han's institute to discuss content of future collaborative research and expected outcomes. He will write a report to provincial government and I will present a paper at Asian Studies Conference. Work on Heilongjiang's economy would be carried out jointly with Xiong Yingwu's (famous Chinese economist) institute of economic research.

AM: meeting with Mr. Xu Jingxue, Director, Siberian and Soviet Far East Research Institute, Heilongjiang Academy of Social Science. He is also establishing a center for Northeast Asian relations. Xu will jointly study with the Soviets (Moscow-based) Sino-Soviet economic relations and trade. He offered to throw a banquet for me next time I went to Heilongjiang and gave me a copy of his book. My HeiDa colleagues were also happy to meet him and got copies also.

July 17 PM: train for Beijing, arrive July 18 noon. Stayed at Beijing University.

July 19 PM: meeting with **China National Gold Corp.**, Mr. Hou Jianping, Vice President, who had been on a delegation that visited CSM. He would also be attending the Minerals and Energy Forum of the Pacific Economic Cooperation Conference as I would the following week. CNGC has a joint venture with Prof. Fendou Wang in a Cripple Creek gold mine. CSM also provides gold assessment services to CNGC.

Mr. Hou was very receptive to a 6-8 week field practicum for CSM students of mining engineering. He suggested several options:
-6 weeks at one mine.
-many mines, 6-8 altogether, one week each, with different conditions and problems, all in a major mining region, Shandong.
-a mix of mines and a week at the Gold University and the Gold Research Institute in Changchun, Jilin. These mines are about 100 miles from the university in Jilin and Liaoning.

He suggested this arrangement could be worked out in the context of improving mutually beneficial relations which he said meant lowering the price quoted to CNGC by CSM for a CSM training program for several mine managers that had been discussed previously when CNGC visited CSM. As it stood now, the cost was too high for his corporation and they could not afford it. I told him I would transmit this information to CSM but I didn't know if it was possible. Need to write him.

July 20AM: **Petroleum University.** Meeting with Vice-President Zhang Siwei and Professor Guo Tianmin for 2 hours, CNPC host Mr. Sun

accompanied me. Petroleum University agreed to accept 2 CSM students each summer to be sent out to a field practicum with Petroleum University students. Doing it this way means no special arrangements are needed for CSM students. They would have the same living and eating arrangements as Chinese students. This still required permission from CNPC since it was their facilities Pet. U. used. Mr. Wu Deqi of CNPC was pursuing this matter to obtain permission. Eul Pang had also spoken to VP Zhang about the field practicum but permission must ultimately come from CNPC.

CNPC & Pet. U. seemed favorably inclined to cooperate because they wanted a stronger overall relationship. They asked how many Pet. U. students CSM could take but of course I had nothing to offer them in return. (Art Kidnay taking one PhD student in the sandwich program helped the whole relationship.) VP Zhang sent his daughter to see me the morning of my departure. She had heard from her father that Eul had said we needed a Chinese language teacher and she would like to offer her teaching services in exchange for a scholarship. Told her I would check with Eul to see what he had in mind.

July 20 PM: **Ministry of Energy, Education Dept.** Long discussion on purposes of forming Ministry as part of reform policies. Education Dept. in charge of training hopes to eventually have all 36 energy related universities under its domain. As it is now, China National Petroleum Corp., China National Coal Corp., and China National Nuclear Corp. have not relinquised control over those universities that were attached to them when they were ministries (e.g., Petroleum University is still under CNPC). Ministry of Energy only has control of 13 power generation universities. The members of the Education Dept. first discussed wanting a linkage agreement with CSM. Later when they realized I did not have any scholarships to offer them, were disappointed and less interested. They still requested materials on CSM and said they would inform universities under their control of CSM programs and that we could establish linkages with individual universities. They have few resources at present since the corporations are reluctant to concede anything to them. However, contact should be maintained with them in case they ever do gain control of the other energy related universities. (guard at the gate of Ministry had fixed bayonet.)

July 21: CNPC assisted my purchase of 8 statistical yearbooks from State Statistical Bureau. Met with Ma Chi, **National Research Center for Science and Technology Development**, SSTC and Xia Wuxiang, Vice President **Huaneng Engineering Technology Dev. Corp.** Both meetings related to energy research interests.

July 22 PM: flight to Hong Kong.

July 23: day of rest.

July 24: Universities Research Service, Chinese University of Hong Kong, Shatin, New Territories. Xeroxed non-stop 1500 pages of

research materials in one day.

July 25 PM: flight to Manila.

July 26: Luncheon arranged for me by John Wolfe and Domingo Lim to meet Manila Chapter of CSM Alumni Association. Approximately 8 people attended. Most are retired and there are no young members because CSM is too expensive for the Philippines. Older alumni (class of '31, '32, '37, '39; youngest, class of '54) had fully-funded support from U.S. when exchange ratio was US$1:Peso 2 (now its 1:21) and CSM tuition was $400. The cost is prohibitive now. The Asian Development Bank was considering a major educational loan to the government's Office of Energy Affairs before the 1986 revolution but all that's on hold for now. It would have been used to train young Philippinos in the U.S. Given that most alumni were retired, they could not help out in setting up field practicum, but thought it was a good idea given the Philippines' complex geological formations and 100-year history of mining.

July 27-28: Third Minerals and Energy Forum meeting (task force of the Pacific Economic Cooperation Conference). Extraordinarily useful for meeting a large number of contacts from the entire region. Quality of most papers presented by Asian participants indicated there was a lot of work to be done in the region in training/educating by CSM. Dr. John Tilton's presentation was a good demonstration to Asian participants of the work being done at CSM.

-met Tom Cutler, Office of International Affairs, DOE. (Southeast Asian officer). wants info on CSM International Institute, also papers I've written on Asian energy relations. Discussed how CSM might participate in any training programs in the pipeline for Vietnam, Kampuchea, and eventually Burma. His office would not fund but would of course be aware of and make decisions about.

-met Mr. Chang Hung-Chiang from Chinese Petroleum Corp.(Taiwan). [Taiwanese difficult for me to come into contact with these days] Discussed sending more Taiwanese students to CSM from his company. He needs CSM materials.

-met Virgilio C. Laroza, Director, Legal Affairs, Office of Energy Affairs, Office of the President, Republic of the Philippines.

-Dr. Dennis O'Brien, Chief Economist, Caltex, who informally leads U.S. participation in MEF, suggested I participate in Assoc. of Political Risk Analysts and would put me in touch with them because "my kind of political analysis was also needed" in Asian energy affairs. Also asked John Tilton and me to help him organize next MEF meeting which would be held in and hosted by U.S.

-met with Pavel Minakir, Soviet delegate to MEF. Director of Institute of Economic Research, Khabarovsk Academy of Science. [knew him from Hawaii] Discussed possible research projects I might do next summer in Soviet Far East, doing a study comparable

to the one I plan for the other side of the border in Heilongjiang. (Harbin only a couple of hundred kilometers from Khabarovsk.) I need to send him my writings on Northeast Asia and a draft of research proposal before I submit it to funding agencies. Also interested in a linkage agreement between his institute and CSM.

-Christopher Findlay, MEF Coordinator and Senior Lecturer at Economics Dept. Australia National University, also interested in international economic implications of China's economic reforms. Discussed possible linkage agreement; must send him my writings.

July 29-31: bus trip (6 hours) to Baguio. Mr. Larry Smith, Philex Mines (CSM alumni, class of '31), and his wife Ruby, my hosts for the weekend. Put me up at Baguio country club, built at the turn of the century by Americans. Philex Mine not the largest but the best run, most profitable mine in Philippines. Employees well-treated and no labor unrest there (only place in Philippines with none). Philex willing to take 3 students on summer field practicum. Philex has staff housing, free to employees, as well as schools, hospital, church and parish priest. Researchers/students from Switzerland, Sweden, Germany, China and Finland have visited Philex. Baguio very attractive mountain region resembling Hawaii or Jamaica. Mr. Smith said I was the first person from CSM to visit Baguio and was very glad to see me there. Also hoped other CSM people would visit. Needs materials and followup letter. Might be fun to write an article on Philex and field practicum.

Aug. 1: American Chamber of Commerce, Minerals and Energy Committee breakfast meeting.(John Wolfe as Chair had organized) 25 people in attendance. I spoke on CSM field practicum, MEF meeting and my China visit. Good attendance but didn't generate any further contacts for establishing field practicum as anticipated.

Aug. 1: appointment with Dr. V.V. Desai, Energy Advisor to **Asian Development Bank**. Explained my work at CSM, Asia-Pacific Rim Center and my research on Asian energy relations. ADB not interested in students. We had both attended MEF meeting so spent time discussing that. Mainly discussed Chinese energy organizations. Desai works with but not familiar with them. He asked if I would be interested in joining an ADB mission to China (7-10 day consultancy with ADB) to work with Energy Research Institute (my research collaboraters) and Ministry of Energy. Timing of mission uncertain, perhaps 6-9 months from now. Desai needs my cv and recent publications, also a citation on U.S.-Japan energy relations published by Atlantic Council. He wants to be notified if my NSF proposal with ERI is funded.

Met with Alberto Balagot, Manager, Industry and Minerals Division, ADB. Discussed CSM as a source of training for Asian countries since ADB loans also include a training component in the loan package. Vietnam a possibility after September; Burma too unstable. Balagot needs large packet of materials on CSM

describing **all** the programs here. He also wanted to know about my experiences in China and what I had seen. I told him about the night terror.
Aug. 2: overtaken by 3-week fever and exhaustion; bedrest and aspirin.

Aug. 3: **Mr. Benjamin Lim, Manager, Energy Research and Development Division, Philippines National Oil Corporation.** (met him at MEF meeting) He needs materials on CSM and field practicum. He's interested in having students in many fields: petroleum engineering, geology, geothermal, coal mining. PNOC an integrated company covering all forms of energy. Right now intensely focused on offshore and onshore exploration which CSM students could participate in for field practicum. His division has attractive facilities and surroundings out in Quezon City near the University of the Philippines to take advantage of the talent there. PNOC would have no problem providing room and board for summer internees; can take several. He's also interested in educational and training possibilities for PNOC employees at CSM, although the severe economic difficulties of the Philippines makes it hard. I told him about what we were doing with China and he asked about a sandwich program for PNOC employees to be worked out in cooperation with the University of the Philippines Minerals and Mining Dept. which he is closely connected to. He will contact them to puruse this further after I send him materials. He will send me PNOC annual report.

Philippines visit: The Philippines presents a challenging situation for trying to develop linkages since it lacks resources and foreign exchange. Because it is an energy consuming rather than a producing country, outsiders are not familiar with Philippino energy-related personalities and organizations who tend not to participate in international forums, probably to save foreign exchange. The MEF meeting was jointly hosted by the Taiwanese and Philippinos, providing an important opportunity for them to network with others from the Asia-Pacific region. I had two strategies for identifying Philippino organizations for the field practicum: the Manila chapter of CSM Alumni Assoc. and its network, and the MEF. The first worked in finding an alumnus at Philex Mine although most alumni were retired. Another alumnus arranged the meeting with AmCham Minerals and Energy Committee, but that didn't generate possibilities for a field practicum. The MEF meeting helped me identify numerous Philippinos, and out of them, the precisely right person to contact for internships. Possibly because they are a consuming country and desperately searching for oil, they were extraordinarily responsive to the idea of accepting CSM students for field practicum.

Aug. 4: depart Manila for Tokyo-Minneapolis-Denver flight. Delayed departure, 8 hours in Manila airport as Northwest ground crew on strike, plane serviced by goons, and a bomb threat left even the pilot nervous. 36 hours later arrive in Denver.

APPENDIX 5

Promoting Linkage Agreements for CSM:
Report on Trip to Indonesia and Malaysia
by James Jesudason

PROMOTING LINKAGE AGREEMENTS FOR CSM:

REPORT ON TRIP TO INDONESIA AND MALAYSIA

INDONESIA (July 17-21, 1989)

I visited three main places in Indonesia -- Amoseas Indonesia in Jakarta (an oil company belonging to the TEXACO group); the Center for Geotechnological Research and Development in Bandung (a member of the Indonesian Institute of Sciences); and PPT Migas (Oil and Gas Manpower Development Centre) in Cepu, Central Java.

July 17

AMOSEAS, INDONESIA: off-shore exploration company in Java.

AM: The head explorationist in Amoseas, Dr. Cary Mrozowski, was very enthusiastic about CSM's initiative in pursuing the internship program. The other American executives there also appeared positive BUT the bottleneck, I learned, lies in the Indonesian bureaucracy. The local Administrative Manager, Mr. A. Alfitri, pointed out that BKKA (Foreign Contractors Coordination Administration), which is an affiliate of Pertamina, closely monitors all employment and expenditure decisions of foreign oil companies. While there might be possibilities for employing CSM staff as consultants, getting internships for students will not be easy. The difficulty does not seem to be one of costs ("what's a few thousand bucks"), but getting approval from the authorities. I next went to see some of the state regulators.

PM: I visited BKKA in the Pertamina complex, and spoke with Mrs. Myrne Tehubijuluw, who is in charge of manpower training for Pertamina and the petroleum industry in general. She thought the idea of bringing students as interns to Indonesia was innovative and a good one in principle. Were we to succeed, BKKA would provide some funds as well as arrange internships directly with the foreign companies. However, Mrs. Tebubijuluw pointed out three salient problems: i) getting visas ii) the very modest support provided by BKKA (small even by Indonesian standards) and iii) the problem of evaluating student performance. Feeling slightly encouraged I next rushed to the Department of Mines and Energy, where my hopes were dashed.

At the Department of Mines and Energy (or Migas), I talked to Mr. Djaman Purba, who is in charge of approving work permits in

the petroleum sector. After a long, meandering conversation, which touched on his love for gambling in Las Vegas, he stated flatly that the benefits CSM students would bring to the oil companies were marginal and hence he could not recommend any permits for them. However, he reinforced the point made at BKKA that the argument for cultural exchange was a far better one than taking the "transfer of technology" line and he suggested that I work through the Education Department.

Some observations: 1) If we want to pursue the practicum idea, we might have to work with the Ministry of Education. My own feeling is that the chances of success are small and will involve a lot of patience and tedious work. However, if successful, the obvious benefit is that BKKA might take care of much of the logistics of the internship program.

Some recommendations: 1) I was advised by Dr. Mzozowski to mobilize Indonesian alumni of CSM, who might be in high places, to help us. 2) Mrs. Tebubijuluw mentioned the possibility of getting Pertamina to provide some internships as well as sending their staff for professional upgrading. The company did not reply to an earlier letter of mine but there might be no harm writing to the Director of General Affairs, Tuan Baharuddin as the next step.

July 18

Flew to Bandung, and visited the CENTER FOR GEOTECHNICAL RESEARCH AND DEVELOPMENT. It is a component of the Indonesian Institute of Sciences (local acronym, LIPI).

The Center for Geotechnical Research is the main governmental R and D center for the exploration and processing of mineral resources, and metallurgical engineering. It has about 80 research personnel. The Center's main external ties are with Japanese universities, and many of its projects are funded by JICA (Japan Investment Cooperation (Corporation?) Agency??) and JSPC (Japan Society for the Promotion of Science), although some funds also come from USGS, NSF, US Aid, and World Bank. I had a long discussion with Ir. Suparka, the Head, and his colleague in metallurgy, Suryadi Ardiwilaga.
Among the chief concerns of the Center are: i) development of small-scale mining technology and models, and determining the economic, environmental, and managerial aspects of this type of mining ii) processing rare earth materials from tailings of traditional ores, e.g., tungsten (from tin), cobalt (from laterite and nickel), and gallium (from bauxite) as well as extraction and processing of zeolite, boron, and raw materials for ceramic iii) estimating the future demand for traditional commodities and assessing the potential of new minerals and composites.

Mutual Cooperation with CSM: Unfortunately, the Center does not have the money nor the facilities for an internship program. However, self-paying CSM students are welcome to carry out their research projects in LIPI.

The most promising areas for cooperation are: 1) Training of LIPI personnel for the MA and PhD degrees as well as providing special certificates for students undergoing various short-term training programs. At present there is only 1 staff member in the US; 5 are in New Zealand and about 5 in Europe. The Center is interested to train a Ph.D in human resource development, and is looking at the US. I think we can get more if some obstacles can be negotiated: i)the government imposes a U.S $ 5,000 tuition limit for study abroad. Can the tuition fee at CSM be reduced? ii) Some of the staff have scored below 550 on the TOEFL. LIPI wants to know what CSM's cut-off point is and whether special allowances can be made. I suggested the idea of a special language training program at CSM prior to their formal study. Of great interest to the Center are the short-term courses (6 months to 1 1/2 years) in specialized areas such as geo-chemistry or geo-physics, including programs where the student can design his own courses. LIPI would like a special certificate to be issued that might help the trainee in his career prospects in the Indonesian bureaucracy.

There also appears to be room for CSM faculty to get involved in joint collaboration and research, though I do not anticipate many consulting possibilities. The Indonesians were very interested in starting an experimental mine in small-scale mining and are wondering how CSM's experimental mine at Idaho Springs can be adapted for such a purpose. The Dept. of Mines is slowly being sold on the idea of small-scale mining, and involvement here could prove fruitful.

Research prospects for CSM faculty are most promising in the area of specialized minerals and their extraction, as well as mineral economics. One of the Center's main concerns is extracting gallium from bauxite at 40 ppm. Currently, commercial exploitation is carried out at 80 ppm.

One important point to bear in mind is that chances for research funding might be increased with joint collaboration between US and developing country researchers. It might be fruitful to write to the following people in the US Embassy in Indonesia for more information on joint projects and international funding:

Jeffrey T. Lutz, Ph.D
Scientific and Technological Affairs
US Embassy Jl. Merdeka Selatan No. 5
Jakarta Pusat, Indonesia
Tel: 360360 Ext. 2071

Mrs Kemala Angraini Ahwil
Economic Section, US Embassy
Jl. Merdeka Selatan 5
Jakarta Pusat 10110

Phone: 360360 Ext. 2370
Telex: 442128 AM EMB JKT

I also learned that other US universities are also involved in Indonesia. A group, Freeport Companies (a consortium of US and Japanese companies), is backing a collaborative tie between the University of Texas, Austin and Institute Technology Bandung for further exploitation of copper in Irian Jaya.

Follow-Up: i) determine the possibility of short-term courses, language training, and the lowering of tuition fees. ii) get a sense of CSM faculty interest in LIPI's projects. iii) explore idea of an experimental small-scale mine.

July 19-21: visited PPT MIGAS (OIL and GAS MANPOWER DEVELOPMENT CENTRE) at Cepu. I had to fly to Surabaya and take a 4 1/2 hour road trip to Cepu.

MIGAS, Cepu, along with its teaching wing, AKAMIGAS, is the main government training center for the oil industry, and is considered to be a vital part of the Indonesianization program. It has 400 - 500 trainees and a teaching staff of 190. The great majority of its students are from Pertamina. The courses are highly job-oriented, and the students (seconded from regular work) spend a total of three years at MIGAS. The center has rather impressive oil-drilling and oil-refining simulators, computer facilities, as well as a small, operating refinery in another town. In addition MIGAS provides special technical and consultancy services to the oil companies, both foreign and domestic. Under the Technical Cooperation Among Developing Countries, AKAMIGAS also provides training to oil-industry personnel in developing countries.

PPT MIGAS agreed right away to sign a linkage agreement with us. It is presently waiting for the green light from the Director General of Oil and Gas. I believe that PPT MIGAS sees a linkage agreement as facilitating entrance into the MA program at CSM. Its staff has had trouble gaining entrance into US universities because of low TOEFL scores. We need to consider, as in the case of LIPI, if CSM can be more lax about the TOEFL scores or if special language programs can be provided to raise English levels. MIGAS wants in particular to train more exploration personnel (e.g., in drilling technology), petroleum engineers, and geologists.
Since PPT MIGAS does provide technical services to the oil companies, an affiliation with it might allow CSM faculty to be brought into the consulting network in Indonesia.

The next step for us is to write to PPT MIGAS, providing information on tuition fees, language requirements, and the duration of various MA programs. They also want a letter stating what we can offer in terms of the MA and in joint consulting services.

MALAYSIA (July 24-26, 1989)

I visited five places in Malaysia -- Shell, Malaysia; University of Malaya (Vice-Chancellor and the Geology Department); Department of Mines, Geological Survey of Malaysia, and Petroleum Research Institute, PETRONAS

July 24, 1989.

AM: SHELL COMPANIES IN MALAYSIA.

I had a discussion with Mr. Henry Lian-Aran, an Executive Director and the Director of Personnel at Shell, focussing mainly on the international practicum. As with Indonesia, I was told that it would be very difficult to get permits for foreign students to work in Malaysia. There is graduate unemployment in Malaysia, and even Petronas (the national oil company) has been freeing the bonds of its scholarship trainees. However, there is a good possibility that Shell might consider an internship program for Malaysian students. Mr. Lian-Aran would not commit himself to any formal agreement or even promise to take a fixed number of interns, but he said that Shell, depending on its needs and the timing of things, would consider students from time to time. However, the students would have to take the initiative to write to him, stating their expertise and interests, and he would try to fix up something for them. My feeling is that Shell is interested in getting good people to work for the company, and this might be a good testing ground. Shell did not indicate any need to rely on the technical services of CSM faculty. It is self-sufficient in that regard-- it has research centers at the Hague and sends its staff for training at various Shell facilities in the UK, Holland, and the US. As for recruitment to CSM, Shell has traditionally sent its scholarship holders and staff to the U.K. Very few have come to the U.S. We ought to perhaps market ourselves better by getting in touch with Tom Rhea who is with Shell-Oil Houston. He is in charge of recruiting for Shell Malaysia and also sees to the needs of Malaysian students studying in the US. I do not have his full address but we should, I think, pass him further information about CSM and get into the network of universities which Shell relies on for training. By the way, Malaysian students are advised to apply directly to Tom Rhea for job possibilities in Shell Malaysia rather than wait for advertisements to appear in newspapers and magazines.

PM: VICE-CHANCELLOR OF THE UNIVERSITY OF MALAYA (UM), Professor Syed Hussein Alatas (in the British system, the Vice-Chancellor is the highest executive officer of the university).

Here I met up with some of the feudal aspects of Malaysia. The Vice-Chancellor, while pleasant to me, wondered why the President

of CSM had not written directly to initiate the linkage agreement -- in others words, I was not a high-level-enough emissary. Nonetheless, the university is in principle interested in cooperation with CSM -- not just in geology but also in the social sciences. One of the vice-chancellor's concerns was whether CSM would waive its bench fees (? sabbatical fees) for its faculty who want to spend their sabbatical leave here.

On July 26, I met with the head of the Geology Department and some of the faculty. I shall report my discussion here.
The department and CSM has had various past associations. Dr. Charles Hutchison was an external examiner some years back and at least one UM staff member has spent his sabbatical at Golden. There appear to be two or three strong research needs and concerns at UM: the rehabilitation of old tin-mining areas for ecological reasons (and I believe to facilitate highway construction); and the exploitation and management of groundwater. The department is also interested in CSM staff applying its traditionally strong research areas to the Malaysian context. The department is hence interested in getting a copy of projects and research in which CSM staff are involved. One interesting proposal the head brought up was getting CSM faculty -- in association with UM faculty -- to participate in Malaysia's consulting business. The government of Malaysia is privatizing a lot of projects and the universities are now able to form consulting groups to compete for bids. Some possibilities are investigating sites for toxic waste disposal and the rehabilitation of ex-mining land (for highway construction). I was told that if UM geologists had someone of international reputation as a member, the chances for a successful bid would be higher.

July 25, 1989

AM: DEPARTMENT OF MINES, MINISTRY OF PRIMARY INDUSTRIES.

The Department of Mines enforces rules on, provides consultancy services to, and develops techniques for the mining industry, and related activities in minerals and metals. I had a discussion with the Chief Economic Officer, Mr. Mustapha Mohd. Lip, and two of his colleagues from Law Enforcement, and Research and Development respectively. Mr. Mustapha is due to visit us on September 6-9, 1989.

The Department of Mines is keen to have CSM input in its research program although details will have to be worked out when Mr. Mustapha visits. The Department requires technical aid in several areas, and hopes to get CSM faculty attached to its several projects, in addition to sending its staff for short-term training

courses, particularly in environmental engineering. The Department's research interests include the following:

i) recovery of fine tin now lost in tailings. They want to optimize tin extraction, which (if I got it correctly) involves both pyro-metallurgy and hydro-metallurgy.
ii) recovery of gold from tin tailings. The tailings have now been found to be rich in GOLD (surface chemistry might be involved here ??).
iii) geo-technics with reference to soil and rock mechanics. Expertise and aid needed in seismic surveys especially involving shallow reflection. Data interpretation of shallow reflection is very difficult in limestone areas.
iv) geo-statistics: oil reserve estimation techniques including determining if information is sufficient for drilling.
v) refining of industrial minerals, particularly kaolin, of which large quantities have been found in Malaysia. Fine-tuning technology for the removal of impurities (sand) and coloring.

Mr. Mustapha raised the following questions: 1) Would CSM be able to provide special rates (or student rates) for food and lodging for its staff sent for technical training?
2) Does CSM collect statistics on mineral activities around the world?

Useful tip: Mr. Mustapha also informed me that Malaysian Mining Corporation (MMC) might be willing to sponsor student interns, and provide around M $100 (around US $37) per month in pocket money. This internship will probably expose the student to the tin dredging sector in Malaysia, and the virtues of simple living. Contact person's name not available in full:

Mr. Azman ....
Personnel Department
MMC
37 th. Floor
Bangunan PNB
Kuala Lumpur, Malaysia.

Next step: Get more specific suggestions for cooperation from Mr. Mustapha when he visits.

PM: GEOLOGICAL SURVEY OF MALAYSIA. I had a discussion with Mr. Chong Foo Shin, its director. The functions of the department are diverse, from systematic geological mapping to providing technical and scientific aid to the mining industry.

Mr. Chong was aware of the strengths of CSM, highlighting its reputation in the geotechnical aspects of mineral resources, but hastened to add that the US was behind in its involvement with GSM

compared to Japan, Canada, and Australia. GSM is quite interested in stronger links with CSM, particularly in joint research. Mr. Chong thinks the best avenue for collaboration is through the grant programs of AID and NSF. (He gave me a letter from the US Embassy in Malaysia bringing GSM's attention to these funding sources) There are some specific grants which favor joint collaboration between US scientists and developing country research scientists and institutions. Since US involvement in this area has been weak in Malaysia, there appear to be real opportunities for CSM staff to begin to link up with GSM.
GSM is also interested in short term symposiums and workshops (3 months) that CSM might offer as well as short-courses (up to a year's duration) for the practicing professional which might lead to a diploma . Mr. Chong wanted more information. The next step is to get a list of such programs and courses for his attention and to solicit interest in CSM staff for joint research possibilities in Malaysia.

July 26, 1989

AM: GEOLOGY DEPARTMENT OF UNIVERSITY OF MALAYA (see above)

PM: met with Dr. Ahmad Zaharudin Idrus, the Director of PETROLEUM RESEARCH INSTITUTE, the research wing of Petronas, Malaysia's National Petroleum Corporation.

The Petroleum Research Institute is doing research on both the upstream and downstream aspects of the oil industry. It is currently engaged in joint research with India on waxi-crude (?) and with a local university on removing carbon dioxide and mercury from natural gas. PRI did not have any specific ideas for collaboration with CSM, nor did the director appear very interested. In a rather supercilious manner, he wanted to know what strengths CSM had compared with specialist centers like Chicago Oil and Gas. Dr. Ahmad wanted a list of on-going projects at CSM and its areas of expertise. Shall we oblige?

MY OVERALL IMPRESSION is that it is going to be very difficult to get a strong internship program going in Indonesia and Malaysia, particularly for US students. Most large multinationals didn't seem interested and for the few that were, the problem was not so much a matter of costs but the strong nationalistic goals of the governments. However, there do appear to be possibilities for recruiting students from these countries to study at CSM, either in formal degree programs or for a short-term period of specialized study. There also appears to be definite possibilities for CSM staff to enter into joint research and even consulting in these

countries, but no one can expect an overnight bonanza. All parties must possess much patience and be satisfied with slow, incremental success.

SOME RECENT DEVELOPMENTS

After my trip, I received more letters expressing interest in a linkage program (see below). Some of the letters were from Thailand, which unfortunately came to late for me to plan a visit.

1. Gadjah Mada University, Indonesia: This is Indonesia's premier university. They want a linkage, and even drafted an agreement. Apparently, President Ansell was mailed a copy.

2. Mines and Geosciences Bureau, Philippines: A cordial letter that found our proposal to be interesting, and expressed a willingness to organize cooperative programs.

3. Chulalongkorn University, Thailand: Thailand's premier university. Letter was very positive, and invited me for a visit.

4. Department of Mineral Resources: Extremely positive, and I think they want a linkage agreement.

5. Universiti Kebangsaan Malaysia: My letter was forwarded to the Department of Geology and I was invited for a visit.

We need to reply and act on some of the proposals and queries of the institutions I visited. And how should we respond to the latest letters?

James V. Jesudason

August 27, 1989.

APPENDIX 6

"How To Design an International Engineer,"
The Mines Magazine, February 1989

HOW TO DESIGN AN INTERNATIONAL ENGINEER

Despite the national hew and cry to make our educational system more responsive to the exigencies of a world economy, not all disciplines within higher education have been the target of efforts to "internationalize." This is particularly true of engineering and the applied sciences, regardless of the fact that such areas as nonrenewable natural resources engineering and environmental sciences have built-in international dimensions to them.

But such is not the case at Colorado School of Mines, which is not just on the leading edge of internationalizing engineering and applied sciences education but is defining what that edge looks like. "The only other programs similar to ours of which I am aware are at the University of Rhode Island and the University of Illinois, Urbana-Champaign," notes Dr. Laura J. Pang of the recently created Department of Global Systems & Cultures and project director

of a grant from the U.S. Department of Education's Fund for the Improvement of Post-Secondary Education to internationalize engineering and science education at CSM.

Dean of Engineering Donald W. Gentry, who recently completed a two-year stint as chairman of ABET, the Accreditation Board for Engineering and Technology, seconds this observation: "CSM is far in advance of many engineering schools today, as it looks at a truly global view of the practice of engineering and science."

Why Internationalize?

When faced with the projection that some 80 percent of today's CSM graduates will spend part of their professional careers outside their home country, the school realized that it was time to change the traditional practice of leaving to chance the engineer's or scientist's ability to perform—optimally or otherwise—in an international setting. Today, 70 percent of all U.S. engineering products and services face international competition. How can an oil corporation be considered competitive if 90 percent of the American engineers it sends to a Southeast Asian country must be brought home within a year because they cannot adapt? And how can a mining concern hope to operate its China project effectively if no one on site speaks Chinese?

As other disciplines and professions began to up the educational ante by providing their students with international expertise, CSM decided not to stand by and leave tomorrow's engineers and scientists to their own devices to try to become globally adept.

Institutionalizing the International Initiative

Operating under a directive from President George Ansell to initiate an international program at CSM, Dean Gentry and Vice President for Student Affairs and External Relations Michael S. Nyikos traveled to Brazil in 1985 as a first step toward creating a unique, liberal arts-based academic program designed to help prepare students for professional life in the global arena. In January 1986, the Latin American Center for Minerals and Energy Development was inaugurated as the first of a planned series of area centers, now housed under the CSM International Institute and charged with the overall coordination and development of new teaching and research opportunities abroad.

Drs. Laura and Eul-Soo Pang of CSM's International Institute.

As a capstone to nearly three years of planning, studying, and debating, the Department of Global Systems & Cultures (GS&C) was brought into being in February 1988. GS&C courses may be applied towards satisfying most of the general undergraduate humanities and social sciences requirements, or may be applied toward a 21-hour minor or 24-hour certificate in International Political Economy.

"Designing a program of study that is accessible to students whose plates are already full with their engineering and science coursework is quite a challenge," observes Dr. Eul Pang, head of the department. "Even with the IPE minor and certificate in place, however, we have reason to believe that an even more in-depth program of study should be given serious consideration." Toward that end, a committee is currently studying the possibility of a fifth-year, dual degree scenario.

Third World Focus

Less difficult than working within curricular confines has been defining the scope of the department itself. "Unquestionably, the lion's share of the world's known mineral and energy reserves lies in the Third world—Asia, Latin America, Africa, and the Middle East—so here, too, must be the heart of the department's efforts," Dr. Pang explains.

This is not to say, however, that courses will concentrate on the behavior of the minerals and energy industries in the Third World. "Far from it," Dr. Pang continues. "The Department of Mineral Economics is already in place for that very purpose. Instead, we provide the student with knowledge of what you might call the macro settings in which these industries must necessarily operate—the political, economic, and social realities, as well as the language and culture of given regions and specific countries."

As such, the department is a carefully conceived confluence of relevant liberal arts disciplines. According to Dr. Pang, "we have no qualms about crossing, merging, and tinkering with traditional disciplinary boundaries when that's what it takes to understand the phenomena that are within our sphere of interest."

Thus, the department's course offerings now range from Indonesian and Portuguese to Revolution in the Third World and Social and Political

BEST COPY AVAILABLE

nge in Asia. Currently, faculty ertise within the department lies in n America and Asia, the latter ponent just getting underway as all 1988. Since the department ed from almost nothing and relies nonies it has raised from outside ces to cover more than half of its rating expenses, it must be careful row at a measured pace. African the Middle Eastern components not be added until appropriate urces are available.

teraction with gineering and ences Faculty

ot content to operate liberal arts vacuum, bal Systems & ures is also exploring s in which to affect a s-fertilization with r departments on pus. Multidisciplinary roaches in the area of ral resources neering and the al sciences offer two nct advantages. rst and foremost, endeavors provide engineering and nces faculty with arch bases abroad, eby diversifying and ching technical ertise across national cultural boundaries. ronmental sciences, ng engineering, and eral processing nologies, as well as oleum engineering refining technologies ire an in-depth reciation of foreign ngs if appropriate nologies are to be eloped.

he second and more obvious efit of such cross-disciplinary boration is to give the school's al scientist opportunities to rve how development policies made and implemented. Unlike al scientists in traditional ersity settings, those at CSM must v more binding concerns and ests in the overall social, omic, and political changes in the d World which are often brought t by resources development.

International Field Practicum

One of the most stringent tests of the department's mettle has come with putting the 24-hour certificate in place. Identical to the 21-hour minor in every other way, the certificate requires an additional 3 credit-hours to be spent by the student practicing his or her profession in another country. The department undertakes the responsibility of contacting corporations and other entities abroad—be they transnationals, parastatals, or foreign-owned private companies—and of making the arrangements for placing students for a minimum of three months, usually during our summer months.

Dr. Laura Pang, under whose auspices this aspect of the program falls, notes that "because our inaugural effort and current strength is in Latin America, this is where we have made these arrangements to date— specifically, in Brazil, Argentina, Chile, and Ecuador. During this past fall semester, however, we initiated contacts and queries in Southeast Asia."

"We have had our share of frustrations with the practicum and are continually looking for ways to overcome them," she continues. "We are operating in the Third World, after all, and the obstacles can be formidable. No entity we've contacted is in a position to provide the student with international airfare, although room and board plus pocket money are not difficult to arrange. Salaries are out of the question, however, and on more than one occasion, fallout from national politics has interfered with out efforts."

"Yet, the response from the companies we have been in touch with is almost always enthusiastic," she added. "In fact, we now appear to have a surplus of confirmed opportunities and a relative dearth of students to take advantage of them."

Students leaving Coolbaugh Hall on campus.

Auxiliary Support

In addition to the U.S. Department of Education grant, Global Systems & Cultures also enjoys the support of the U.S. Information Agency's University Affiliates program which allows the department to bring visiting professors from Brazil, Chile, and Argentina. "In fact," says Dr. Eul Pang, "we are the only institution in the country to hold more than one University Affiliates grant concurrently, and we consider that to be quite an honor."

Library holdings on Latin America, Asia, and general international themes in the social sciences are being expanded notably through the generous support of the Tinker Foundation and the Pfizer Foundation. The Exxon Education Foundation has also been a contributor to other operational aspects of the program.

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THE VIEW FROM LATIN AMERICA

by Patricia Curtis Petty

While CSM's international activities are recontouring the educational and professional landscape of engineering and the applied sciences, their impact is not limited to the United States. That this should be the case was succinctly articulated recently when the Department of Global Systems & Cultures hosted a visit from Mr. Milton Drucker, head of the Ecuador Desk at the U.S. Department of State and formerly the Natural Resources Attache with the U.S. Embassy in Brazil. I had the pleasure of interviewing Mr. Drucker and found his comments to be quite unexpected and gratifying.

According to Mr. Drucker, "the new generation of managers and government in Latin America does not have a strong affiliation with the United States—old ties were fraying. The benefits which had accrued in the past were slipping, and equipment, services, and most importantly, knowledge, are coming from other sources—not the United States." He went on to explain that the program as instituted by Dr. Pang can help American interests as well as be exciting from the Brazilian point of view—and from the point of view of other Latin American nations.

"Brazil is a storehouse of unknown quantity and value," Mr. Drucker continued. Eul Pang talked to all the publics interested in this kind of educational and practical exchange—and impressed each one of them with his fantastic knowledge of the country. He not only came with a nucleus of the program planned, he was able to explain how it would help Brazil. His work has been equally thorough in other nations of Latin American where he established contacts."

A TRIP TO THE EAST-WEST CENTER

by Gaye Christoffersen

Although establishing linkage agreements with universities in the Pacific Rim is a part of my job as the new Asianist in the Department of Global Systems and Cultures, my efforts to do so with the East-West Center in Honolulu seemed a bit odd. It is an American research institute funded by Congress and therefore not strictly part of "my beat." Yet it is a part of America in the middle of the Pacific Ocean, an organization noted for developing the notion of the "Pacific Rim" and the "Asia-Pacific Region" for the past 28 years, and housing an institute, the Resource Systems Institute, with a large cadre of Asia-Pacific energy and minerals expertise. The years I had spent at RSI before taking a position at Mines had introduced me to the world of Asian energy. A linkage agreement with the East-West Center would do much to bring more students from Pacific Rim countries to the Colorado School of Mines and also provide Mines' students with opportunities to develop some expertise on energy and minerals issues in the Pacific Rim through internships at the East-West Center.

The visit to the East-West Center took place over a period of a week. Initial meetings ended inconclusively, probably due to the paperwork and financial arrangements that would have to be worked out, as well as the potential opposition from the University of Hawaii where East-West Center students are generally enrolled. Mines would be cutting into Hawaii's "market share" of EWC students. Most organizations do not respond well to initiatives that require something out of the routine.

Meetings with the program leaders, however, took on a more enthusiastic tone. Fereidun Fesharaki, leader of the Energy Program, and Allen Clark, leader of the Minerals Program, both voiced support for the agreement. Clark stated he had in the past turned away applicants to the East-West Center that he had wanted because the University of Hawaii did not offer the kinds of courses they needed. He felt that Mines could fill that gap. His program in the past has hired Mines' graduates as research fellows and Mines' students as research interns and has always found them valuable. Clark hoped the agreement could streamline the procedures for East-West Center exchanges with Mines as it had been on a case-by-case basis in the past.

My last meeting was with the Institute's assistant director, Mike Manson, to reword the standard form to better fit the situation between Mines and RSI. This final meeting was geared to working out the details.

As I left Honolulu, I felt satisfied that my small effort in establishing this linkage agreement had helped in the internationalization of the Colorado School of Mines and that Mines students would in the future experience some of what I had personally experienced while a participant at the East-West Center.

Dr. Gaye Christoffersen is the newest member of the Dept. Global Systems & Cultures, a part of CSM's International Institute. She is an assistant professor of political science and Asian studies, and her research interests include energy policy of China, resources development in Asia and Asian "inter-state" relations.

Geophysics and Mining Connections in Latin America

For this past year, CSM Geophysics faculty have been involved in training officials of the Colombian Petroleum Corporation (ECOPETROL) in the latest geophysical techniques and methodologies. The contract between the school and ECOPETROL (and its research arm, Colombian Petroleum Institute) calls for a 20-month project by CSM faculty to upgrade and modernize the human resources of the state oil monopoly. Each month, one CSM faculty member travels to Bucaramanga, Colombia, to offer a month-long course. It is a sterling example of internationalizing the School of Mine's engineering faculty experience as well as contributing directly to the growth of the Colombian petroleum economy.

Not to be outdone by the Geophysics Department, the school's Mining Engineering Department, is collaborating with the University of Antofagasta, Chile. Two mining faculty went to Chile during November and December, two others will go in June and July to offer professional upgrading courses for private and public industry people. The program began in Summer 1988 and will continue this year.

On both projects, Dr. Don W. Gentry, dean of Engineering and Undergraduate Studies, took the initiative of opening up the opportunities in Chile and Colombia. Dr. Phillip Romig, head of the Geophysics Department, Dr. Miklos Salamon, head of the Mining Engineering Department, and Dr. Eul-Soo Pang, director of the Latin American Center were responsible for overseeing the details of the final contracts and implementing the projects.